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OBJECTIVES

1. Conduct sensitivity analyses, including error and accuracy analyses, of the various vegetation index equations.

2. Continue processing of multiangular ASAS data and multitemporal TM data collected over the Walnut Gulch Experimental Watershed in Arizona.

3. To functionally couple vegetation index products to plant biophysical parameters.

TASK PROGRESS

The best features of several vegetation indices are being implemented into a single index equation with the goal of minimizing both atmospheric and ground contamination problems. The resulting index appears similar to the NDVI equation, but with "calibration" coefficients added to correct for ground and atmosphere influences while maintaining sensitivity to plant biophysical parameters. Major progress has been made on a systems based' noise and uncertainty analysis of the vegetation index which will be traceable to the sensor as well as allow coupling to ground biophysical parameters such as LAI, biomass, %cover, and APAR.

1. Vegetation Index Manuscript:

A manuscript was prepared and submitted to Remote Sensing of Environment, special issue on the "Remote Sensing of Soils and Vegetation" Workshop held in Tempe, Arizona on January 6-8, 1993. The manuscript is entitled "Development of vegetation and soil indices for MODIS-EOS" and is co-authored by C. Justice and H. Liu. This paper was based on the "MODLAND Vegetation Index Workshop" held on June 22, 1992 at NASA/GSFC. This was also presented as a 20 minute paper at the "Remote Sensing of Soils and Vegetation" Workshop in January, 1993. This manuscript presents the current status of various vegetation index equations being considered by MODLAND. Validation criteria were

presented, including signal to noise ratios' and percent vegetation equivalent uncertainties'.

2. ASAS Data Analyses:

One research specialist worked nearly full time on ASAS data processing of the Walnut Gulch, Arizona site. The bidirectional reflectance behavior (uncorrected for atmosphere) of several sites were analyzed. This was a tedious process since the multi-view data cannot be registered without sacrificing the radiometry of the data. Thus representative areas were chosen manually at each viewing angle and then re-constructed to form bidirectional reflectance curves. The areas analyzed thus far include a semi-desert grassland, mixed grass-shrub, desert shrub, mesquite bosque, and riparian areas. The ASAS data set will be continued with atmosphere correction as the measured' optical depths are nearly processed.

3. Landsat TM Data Analyses:

Eight of 10 multi-temporal TM images over the Walnut Gulch Experimental Watershed (1992) have been processed with the goal of analyzing vegetation index sensitivity to changes during a growing season. This data set is accompanied by multi-temporal, ground-based and low altitude aircraft measurements. Thus far only the grassland site has been extracted. The other shrub and riparian areas will also be extracted so as to compare the seasonal spectral behaviour of different vegetation types. It is not yet clear what level of sensitivity is needed to be able to detect seasonal growth' changes in semi-arid regions. Initial results will be presented at the PECORA conference in Sioux Falls, South Dakota, August, 1993. When the TM imagery is completed, we expect it to serve as a useful validation data set and it will be made available to MODLAND.

4. AVHRR Multitemporal Compositing:

One of my Ph.D students, Qi Jiaguo, is using a 3-year, 1 km AVHRR data set over the Walnut Gulch Experimental Watershed amassed by the EROS Data Center (EDC). Qi is working on a Vegetation Index Compositing dissertation, which he hopes to finish this August. The EDC data set is a 20 x 20 window of 1 km pixels and serves as a test for application of different compositing algorithms.

5. MSS-Test Sites:

We were able to read some of the MSS data, including the scenes from China. 45 MSS scenes covering LTER, IGBP, IBP, MAB, NPS, and Eos-IDS study areas were provided to us from EDC in Sioux Falls.

6. Niger-HAPEX Activities:

The Niger-HAPEX, ground-based data collected during the summer of 1992 in Niger is processed and has been sent to the HAPEX information system (database). A Ph.D student, Wim van Leeuwen, is working full time on this data set for his dissertation work. Subsites of interest include millet, grassland, degraded shrub, fallow, and tiger-bush plateau and involve ASAS, TM & SPOT satellite, multitemporal light aircraft with Exotech and IRT, and ground radiometry with Exotech and Spectron SE 590 data. Wim is leaving for Toulouse to present some of the data we collected and to gather other data needed for our projects here, including MODIS validation of vegetation products.

NEXT QUARTER ACTIVITIES

1. Visit the Laboratory of Resources and Environment System (LREIS) in the Institute of Geography of the Chinese Academy of Sciences in Beijing. The 16 day trip will begin on May 19 and will include visiting 2-3 potential "test" sites for future collaborative work and MODIS validation work. As of yet, these 2 sites have yet to be defined, but will be from the list presented in the last semi-annual report.

2. Portugal field campaign. Under a project funded by NATO, I will be conducting some field radiometry in Portugal this summer for 2 weeks.

3. Initiate level 3, compositing of the vegetation index. This includes an assessment of all the uncertainties involved in the maximum value compositing (MVC) technique. This technique assumes a lambertian surface which, in most cases, is not valid. A more vigorous, new compositing methodology is needed with justified assumptions and criteria.

4. Prepare for pre-SCAR field radiometry and vegetation sampling activities along the east-coast of the U.S. Also start preliminary planning for a SCAR experiment in Brazil in 1994 or 1995.

PUBLICATIONS

Huete, A.R., Justice, C.O., and Liu, H., "Development of vegetation and soil indices for MODIS-EOS" , Remote Sens. Environ. (Submitted 1-93)

Qi, J., Huete, A.R., Moran, M.S., Chehbouni, A., and Jackson, R.D., 1993, Interpretation of vegetation indices derived from multi-temporal SPOT images, Remote Sens. Environ., 44:89-101.

van Leeuwen, W.J.D., Huete, A.R., Duncan, J., and Franklin, J., 1993, Radiative transfer in shrub savannah sites in Niger -- preliminary results from HAPEX-II-Sahel: 3. Optical dynamics and vegetation index sensitivity to biomass and plant cover, Agric. and Forest Meteorology (Submitted, 2/93).

Qi, J., Chehbouni, A., Huete, A.R., and Kerr, Y.H., 1993, A modified soil adjusted vegetation index, Remote Sens. Environ. (Submitted 2/93).

Franklin, J., Duncan, J., Li, X., Huete, A.R. and van Leeuwen, W.J.D., 1993, Radiative transfer in a shrub savannah -- preliminary results from HAPEX-II-Sahel: 2. Modelling surface reflectance and vegetation indices using a geometrical-optical approach, Agric. and Forest Meteorology (Submitted, 2/93).